Hatchery-reared Mekong giant catfish utilized deep areas in the Mae peum reservoir, northern Thailand

HIROMICHI MITAMURA[1], NOBUAKI ARAI[1], YASUSHI MITSUNAGA[2], THAVEE VIPUTHANUMAS[3], AND METHA KHACHAPHICHAT[4]

[1] *Graduate School of Informatics, Kyoto University, Kyoto 606-8501, Japan*
Email: mitamura@bre.soc.i.kyoto-u.ac.jp
[2] *Faculty of Agriculture, Kinki University, Nara 631-8505, Japan*
[3] *Inland Feed Research Institute, Kasetsart University, Bangkok, 10900, Thailand*
[4] *Phayao Inland Fisheries Research and Development Center, Phayao, 56000, Thailand*

ABSTRACT
The juvenile and young hatchery-reared Mekong giant catfish *Pangasianodon gigas* have been released into the reservoirs throughout Thailand. For the sustainable reservoir fishery of the giant catfish, new science-based fishery management measures are expected in Thailand, such as the establishment of protected areas. Therefore, the habitat use of the hatchery-reared giant catfish has been investigated in the Mae peum reservoir from 2003 to 2005. Our results suggest that the hatchery-reared fish primarily utilized deep areas in the reservoir. The deep areas which the fish primarily utilized may be suitable as protected areas in the reservoir.

KEYWORDS: MCTP, *Pangasianodon gigas*, protected areas, acoustic telemetry

INTRODUCTION

The Mekong giant catfish is an endemic species to the Mekong River Basin (Akagi et al. 1996, Rainboth 1996, Hogan 2002). This catfish is one of the largest freshwater fishes in the world, measuring up to 3 m in length and weighing more than 300 kg (Rainboth 1996, Mattson et al. 2002, Hogan 2004). Historically, this species was distributed throughout the basin from China to Vietnam, but it now appears to be limited to the Mekong River and its tributaries in Thailand, Lao People's Democratic Republic (Lao PDR), and Cambodia (Hogan 2004). In Southeast Asia, this giant catfish has been popular food for the local people, and is one of the most important and high-value fishery species (Akagi et al. 1996). However, the catch number of wild catfish in the Mekong River has declined due to development of the river and over-fishing (Poulsen & Viravong 2002, Hogan 2004). At present, the catfish is listed in the Convention on International Trade in Endangered Species (CITES) Appendix I and on the International Union for the Conservation of Nature and Natural Resources (IUCN) Red List of threatened species as a Critically Endangered Species.

In Thailand, an artificial propagation technique for the catfish (F1) was developed in 1983 (Mattson et al. 2002), and a second generation of catfish (F2) was successfully produced in 2001 (Pawaputanon 2007). Both F1 and F2 hatchery-reared juvenile and young immature catfish (Figure 1) have been released by the government of Thailand (Pawaputanon 2007) into lakes and reservoirs (e.g. Mae peum reservoir and Sirikit reservoir, Figure 2) in Thailand as fishery resources for local people. Giant catfish have recently been harvested from reservoirs by local fishermen and have been valuable in market trade (Mattson et al. 2002). Given the need for sustainability of the giant catfish fishery in reservoirs, fisheries research will be indispensable for science-based fishery management measures such as the establishment of protected areas for fisheries (residential and spawning areas), closed seasons, and regulations for fishing gear (Bhukaswan 1980, MRC 2005, Pawaputanon 2007).

Fig. 1. First-generation juvenile giant catfish.

A detailed understanding of the habitat use and movement patterns of fish species can contribute to effective fisheries management through the use of protected areas (Humston et al. 2005, Topping et al. 2006). Therefore, we have investigated the habitat use and movements of the F1 and F2 giant catfish in Mae peum reservoir from 2003 to 2005 (Mitamura et al. 2006, 2007, in press, submitted). These studies were performed within the context of the Mekong giant catfish tracking project (MCTP) to conserve and manage its species (Arai et al. 2005). In this paper, we introduce our results of the studies that focused on the habitat use of the hatchery-reared giant catfish in the Mae peum reservoir.

MAE PEUM RESERVOIR

The Mae peum reservoir is located in the province of Phayao, Thailand (Figures 2, 3). The area was approx. 8.3 km^2, and maximum depth was approx. 15 m. The water level of the reservoir is regulated by overflow and was mostly stable during the year of the study. Local fishermen harvest the giant catfish as well as other fishes using gill nets in the reservoir. Algae as a potential food source for herbivorous giant catfish are abundant along the shallow inshore areas of the reservoir.

FISH, TAGGING AND MONITORING SYSTEM

All fish used in the study were immature (Mattson et al. 2002), both first generation (F1) and second generation (F2), hatchery-reared fish. The average $\pm$ S.D. body lengths of F1 and F2 fish were 112 $\pm$ 5 cm and 63 $\pm$ 2 cm, respectively. Ultrasonic coded transmitters (V16P-5H, V9P-1H: Vemco Ltd., Nova Scotia, Canada) were surgically implanted into the peritoneal cavity of fish under anaesthesia that was induced using 0.1% 2-phenoxyethanol. A previous experiment demonstrated that intra-peritoneal implantation had no discernible effect on survival or growth over a period of approximately 2 months (Mitamura et al. 2006). Seven to 14 fixed monitoring receivers (VR2 system: Vemco Ltd.) were used to monitor the tagged fish. The monitoring receivers logged data on the presence (identity, ID). See more detail of the study methods in Mitamura et al. (in press, submitted).

HABITAT USE

Both F1 and F2 fish exhibited variation in their horizontal distribution between the period of 30-40 days after release and the subsequent period (Mitamura et al. in press, submitted). The fish used large areas of the reservoir for approximately 30-40 days after release (Figure 3). During this period, the fish may have been searching for suitable habitats within the reservoir. The fish gradually showed less large-scale movements, and the utilized areas of the fish became smaller. The areas primarily utilized by the fish are part of the old river channel and are deep areas of the reservoir (Mitamura et al. in press, submitted). The F1 fish seldom used shallow areas such as inlets (Mitamura et al. in press). These observations correspond to local fishermen's knowledge and experience that giant catfish can be harvested using gill nets along the old river channel in the reservoir. Moreover, our findings are supported by previous reports that these fish prefer deep holes for habitat in the Mekong River (Poulsen and Valbo-Jorgensen 2001, Poulsen et al. 2002).

a)

b)

c)

Fig. 2. Locations of the Mae peum reservoir, Phayao Province, and the Sirikit reservoir, Uttaradit Province, Northern Thailand (a). Photos of the Mae peum reservoir (b) and the Sirikit reservoir (c).

The use of protected areas has increased globally and has contributed to the recovery of endangered populations and to sustainable fisheries of target species (Parsons et al. 2003, Kaunda-Arara and Rose 2004, Topping et al. 2006). One approach for developing a sustainable giant catfish fishery in the reservoir may be the establishment of a protected area that encompasses the utilized areas of the fish. The protected area as well as conventional fishery regulations (e.g. the control of fish size limit, and restriction of fishing gear), based on the number of fish stocked and caught, may be a much better fishery management strategy for the Mekong giant catfish.

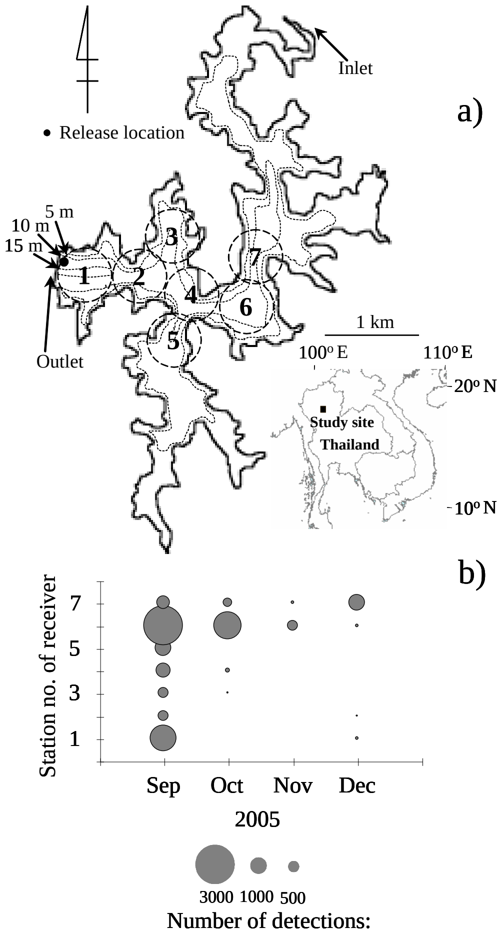

Fig. 3. (a) Map of the Mae peum reservoir in the province of Phayao, Thailand. The numbers (1-7) represent the locations of monitoring receivers. Dashed circles represent the expected signal detection range of the coded ultrasonic transmitters. The small filled circle represents the location of fish release. (b) Example of monthly horizontal distribution of a fish. Each filled circle in a month means the numbers of transmitter signal detected by each monitoring receiver. The fish were released on 1 September 2005.

REFERENCES

Akagi, O., Akimichi, T., Fumihito, A., Takai, Y. 1996. An ethonoichthyological study of *Pla buk* (*Pangasianodon gigas*) at Chiangkhong, Northern Thailand. *Bull. Nat. Muse. Ethno*. **21**; 293-344.

Arai, N., Mitamura, H., Mitsunaga, Y., Viputhanumas, T. 2005. Mekong giant catfish tracking project (MCTP): preliminary results in 2002. In: Spedicato M.T. Lembo G. Marmulla G. (Eds) Aquatic telemetry; advances and applications. Rome FAO/Coispa. 125-131.

Bhukaswan, T. 1980. Management of Asian reservoir fisheries. *FAO Fisheries Technical Paper 207*, pp. 69.

Hogan, Z. 2002. Mekong fisheries network newsletter. *Mekong fish Catch and Culture* **7**(4); 1-19.

Hogan, Z.S. 2004.Threatened fishes of the world: *Pangasianodon gigas* Chevey, 1931 (Pangasiidae). *Env. Biol. Fish.* **92**; 210.

Humston, R., Ault, J.S., Larkin, M.F., Luo J. 2005. Movements and site fidelity of the bonefish *Albula vulpes* in the Northern Florida Keys determined by acoustic telemetry. *Mar Ecol Prog Ser* 291:237-248

Kaunda-Arara, B., Rose, G.A. 2004. Homing and site fidelity in the greasy grouper *Epinephelus tauvina* (Serranidae) within a marine protected area in coastal Kenya. *Mar Ecol Prog Ser* 277:245-251.

Mattson, N. S., Buakhamvongsa, K., Sukumasavin, N., Tuan, N., Vibol, O. 2002. Mekong giant fish species: on their management and biology. *MRC Technical Paper No. 3.* Mekong River Commission. 1-29.

Mitamura, H., Mitsunaga, Y., Arai, N., Viputhanumas, T. 2006. Comparison of two methods of attaching telemetry transmitters to the Mekong giant catfish, *Pangasianodon gigas. Zool Sci* 23:235-238

Mitamura, H., Mitsunaga, Y., Arai, N., Yamagishi, Y., Khachaphichat, M., Viputhanumas, T. 2007. Vertical movements of a Mekong giant catfish *Pangasianodon gigas* in Mae peum reservoir, northern Thailand, monitored by multi-sensor micro data logger. *Zool Sci* 24:643-647

Mitamura, H., Mitsunaga, Y., Arai, N., Yamagishi, Y., Kachaphichat, M., Viputhanumas, T. Horizontal and vertical movement of Mekong giant catfish *Pangasianodon gigas* measured using acoustic telemetry in Mae peum reservoir, Thailand. *Fish Sci* (in press)

Mitamura, H., Arai, N., Yamagishi, Y., Kawabata, Y., Mitsunaga, Y., Khachaphichat, M., Viputhanumas, T. Habitat use and movement of the hatchery-reared F2 Mekong giant catfish in the Mae peum reservoir, Thailand, studied by acoustic telemetry. *Fish Sci* (Submitted)

MRC (Mekong River Commission) 2005. *Fisheries Annual Report 2005*. Vientiane. pp. 49.

Parsons, D.M., Babcock, R.C., Hankin, R.K.S., Willis, T.J., Aitken, J.P., O'Dor, R.K., Jackson, G.D. 2003. Snapper *Pagrus auratus* (Sparidae) home range dynamics: acoustic tagging studies in a marine reserve. *Mar Ecol Prog Ser* 262:253-265

Pawaputanon, O. 2007. An introduction to the Mekong fisheries of Thailand. *Mekong Development Series No. 5.* Mekong River Commission, Vientiane, Lao PDR. pp. 54.

Poulsen, A.F., Valbo-Jorgensen, J. 2001. Deep pools in the Mekong River. *Mekong Fish Catch and Culture* 7: 1-3.

Poulsen, A.F., Viravong, S. 2002. Fish migration and the maintenance of biodiversity in the Mekong River basin. *Mekong Fish Catch and Culture* **8(1);** 1-5.

Rainboth, W.J. 1996. Fishes of the Cambodian Mekong. FAO: Rome, pp. 153.

Topping, D.T., Lowe, C.G., Caselle, J.E. 2006. Site fidelity and seasonal movement patterns of adult California sheephead *Semicossyphus pulcher* (Labridae): an acoustic monitoring study. *Mar Ecol Prog Ser* 326:257-267